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Projection Problem

P A M Seuren, Max Planck Institute for Psycholinguistics, Nijmegen, The Netherlands

The projection problem was considered the central problem in presupposition theory during the early 1970s. After that, it was realized that it is automatically accounted for in terms of a wider theory of presupposition and discourse semantics.

The projection problem is posed by the behavior of presuppositions of embedded clauses. The property of presuppositions to be sometimes preserved through embeddings, albeit often in a weakened form, is called *projection*. The projection problem consists of formulating the conditions under which the presuppositions of an embedded clause (a) are kept as presuppositions of the superordinate structure, or (b) remain as an invited inference that can be overruled by context, or (c) are canceled.

Let sentence *B* presuppose sentence *A* ($B \gg A$); then *B* also semantically entails *A* ($B \models A$). Now, when B_A (*B* presupposing *A*) is embedded in a larger sentence *C*, then either $C \models B_A$ or $C \not\models B_A$. When $C \models B_A$, then $C \gg A$. That is, when B_A is entailed (or presupposed) by its embedding clause *C*, then *C* inherits the presuppositions of B_A. For example, $(1a) \gg (1b)$ and $(1c) \models (1a)$. Therefore, $(1c) \gg (1b)$:

(1a) Susan got her money back.
(1b) Susan had lost her money.
(1c) Susan managed to get her money back.

The operator *and* is the only exception. When a conjunction is of the form 'A and B_A' (the first conjunct expresses the presupposition of the second), B_A is entailed, yet *A* is not presupposed. Thus, although $(1a) \gg (1b)$ and $(2) \models (1a)$, $(2) \not\gg (1b)$, but it is still so that $(2) \models (1b)$:

(2) Susan had lost her money and she got it back.

Entailment is thus 'stronger' than presupposition in the sense that entailments are properties of sets or series of sentences, whereas presuppositions are properties of single sentences.

When $C \not\models B_A$ (and hence $C \not\gg B_A$), then, in all cases but one, $C \not\models A$ (and hence $C \not\gg A$). The one exception is negation: $(3a) \gg (3b)$ and $(3c) \gg (3b)$, even though, obviously, $(3c) \not\models (3a)$:

(3a) Only Jim laughed.
(3b) Jim laughed.
(3c) Not only Jim laughed.

This answers question (a), except for the behavior of *and* and *not*.

When entailment is lost *A* often remains an *invited inference* of *C* ($C > A$). When $C > A$, the suggestion is that *A* is true if *C* is true, but the inference can be overruled by contextual factors. Moreover, when $C > A$, *A* followed by *C* makes for an orderly bit of discourse, just as when $C \gg A$. Presuppositions thus differ from other entailments, which are never kept as invited inferences across nonentailing embeddings. Thus, $(4a) \gg (4b)$ and $(4c) \not\models (4a)$, but $(4c) > (4b)$.

This inference is overruled in (4d), which says that Harry wrongly believes that he has a son, and that this (nonexistent) son lives in Kentucky:

(4a) Harry's son lives in Kentucky.
(4b) Harry has a son.
(4c) Harry believes that his son lives in Kentucky.
(4d) Harry has no son, but he believes that he has one and that this son lives in Kentucky.

In the case of *if* the antecedent clause may express the presupposition of the consequent clause. In such cases, the presupposition is canceled, as in (5a). Similarly for *or*: one disjunct may cancel the presupposition of the other, as in (5b):

(5a) If Harry has a son, his son lives in Kentucky.
(5b) Either Harry has no son, or his son lives in Kentucky.

Not is again problematic in that it normally lets presuppositions project as invited inferences, but occasionally as full presuppositions, as in (3c), and occasionally also cancels them altogether, as in (6), which contains the positive polarity item *hardly* (positive polarity items only allow for a higher *not* if some presupposition is canceled):

(6) Bob does NOT hardly feed his dog: he doesn't even have one.

This gives an idea of what is involved in the questions (b) and (c). None of the proposals made in the literature has been able to offer a principled account of the projection properties of presupposition.

The first proposal was made by Langendoen and Savin (1971), who proposed that presuppositions are always maintained as such through embeddings, which is observationally inadequate. A more sophisticated theory was proposed by Karttunen in various publications. Observing that projection properties depend on the embedding operator, he distinguished between *plugs*, *holes,* and *filters*. Plugs are operators that always cancel presuppositions and invited inferences. Holes are operators that always let them through, either as presuppositions or as inferences (e.g., *believe*). Filters sometimes let them through and sometimes do not (e.g., *not*, *if*, *or*). He did not succeed, however, in formulating adequate conditions for the three classes, in particular the filters. It is now generally agreed that though Karttunen's work focused attention on these phenomena, it was too taxonomic and failed to provide a satisfactory solution.

The second main approach is Gazdar (1979). Here, presuppositions are brought together with entailments and implicatures into one system of hierarchically ordered cancellation conditions. The notion of entailment is classical, and so is the logic administering it. In principle, all implicatures and presuppositions are deemed to 'survive' through embeddings, unless there is a conflict, in which case selective canceling ('filtering') takes place. Implicatures and presuppositions of the smallest possible sentential structures are spelled, respectively, 'im-plicatures' and 'pre-suppositions.' Only when they have made it to the surface, through all embeddings, is the spelling 'implicature' and 'presupposition' (without hyphen) used.

Im-plicatures are scalar or clausal. Scalar implicatures are of the kind familiar in pragmatics: an expression *e* occupying a position on a semantic scale *s* generates the scalar im-plicature 'not stronger than *e*'. Thus, *Some men died* has the scalar im-plicature K(not all men died) – read as 'for all the speaker knows, not all men died.' Clausal im-plicatures are generated by sentences *A* containing as a subpart some clause *B* such that *A* entails neither *B* nor $\neg B$. The im-plicature is then of the form $P(B) \wedge P(\neg B$, 'P' standing for the epistemic possibility operator (Gazdar, 1979: 58–59). Thus, *Nob thinks that Bob is brave* clausally im-plicates P(Bob is brave) $\wedge$ P(Bob is not brave). A pre-supposition is an implicature that is also semantically entailed. A presupposition, as a property of a possibly complex sentence, may or may not be entailed.

The filtering mechanism works as follows. Given a sentence *A* an inventory is made of its eventual entailments (**E**), of its accumulated im-plicatures (**I**), and of its accumulated pre-suppositions (**P**). If **E** contains contrary entailments, *A* is uninterpretable. If some $\mathbf{e} \in \mathbf{E}$ is incompatible with any $\mathbf{i} \in \mathbf{I}$ or $\mathbf{p} \in \mathbf{P}$, **i** or **p** is canceled and *A* remains interpretable in all contexts compatible with **E**. If some $\mathbf{i} \in \mathbf{I}$ is incompatible with some $\mathbf{p} \in \mathbf{P}$, **p** is canceled and **i** remains. Mutually incompatible im-plicatures or pre-suppositions cancel each other. Entailments thus take precedence over im-plicatures and im-plicatures over pre-suppositions. For example, 'if A then B' generates the im-plicature $P(A) \wedge ($ P(not-A) $\wedge$ P(B) $\wedge$ P(not-B), all four being admissible knowledge states. If *B* presupposes *A*, the pre-supposition K(A) is canceled by the incompatible im-plicature P(not-A).

Gazdar was among the first to stress the relevance of presupposition for an incremental theory of discourse semantics. Given a context (i.e., a set of propositions) **C**, a newly presented sentence *A* is incremented to **C**, thus creating a new context **C**′ for a following sentence. Eventual presuppositions (including invited inferences) are incremented to **C** prior to their carrier sentences (Gazdar, 1979: 132). Incremented propositions are considered linked by *and*. When $\mathbf{C} \wedge A$ is inconsistent, *A* is uninterpretable

in **C**. When **C** is incompatible with some $\mathbf{i} \in \mathbf{I}$ or $\mathbf{p} \in \mathbf{P}$ ($A \not\models p$), then **i** or **p** is filtered out and *A* loses that implicature or pre-supposition in **C**. This incremental aspect of Gazdar's theory is an extension of the filtering mechanism to any context **C**, as the same results are obtained by conjoining *A* with (the sentences expressing) the propositions in **C**.

A more unifying view is obtained when the principles of Maximal Unity (MaU) and Minimal Size (MiS) are assumed for **D**s. MaU entails a maximal leveling of information through the subdomains of a discourse domain **D**. MiS entails that what has been incremented must not be doubted again. MaU ensures that besides what is explicitly incremented in a subdomain $\mathbf{D_n}$, $\mathbf{D_n}$ also contains all information previously stored in higher domains, including the commitment domain $\mathbf{D_o}$, provided $\mathbf{D_n}$ remains consistent. This *downward percolation* allows the use of discourse addresses and increments from higher domains in lower domains. The counterpart of downward percolation is the *upward percolation* of presuppositions from lower to higher domains unless stopped by inconsistency with either explicitly stored information or available background (scenario) knowledge. Thus, in (4c) MaU generates the invited inferences that Harry has a son and that there is a place called 'Kentucky.' The invited inference that Harry has a son is blocked in (4d) because the higher domain says that he has no son.

Some subdomains are subject to the requirement that they be themselves incrementable to their superordinate domain. The subdomain created by epistemic *may*, for example, require that what is said to be possible is a proper potential increment to $\mathbf{D_o}$, and must thus be consistent with $\mathbf{D_o}$, but not already contained in it. Likewise for the discourse-splitter *or* and the hedger *if*. 'A or B' is incremented as two alternative subdomains 'A' and 'not-A and B.' Both alternatives must be incrementable to $\mathbf{D_o}$. This condition automatically blocks the projection of (4b), 'Harry has a son,' from the disjunction (5b): if (4b) were added to $\mathbf{D_o}$ the first alternative would not be incrementable. Analogously for conditionals, as in (5a): there is no invited inference that Harry has a son because if there were, it could not be doubted again by *if* in virtue of MiS.

And is primarily a discourse-incrementer; its being a truth function is derived from that (which explains why *and* does not like to stand under negation). $A \wedge BA$ does not presuppose (or invite the inference) A because if it did, *A* would have to be incremented twice, which would violate MiS.

Not(BA) normally preserves the presupposition *A* as an invited inference, because *BA* under *not* must have the right papers for the current **D**. Yet *not* is special. First, it is not allowed over positive polarity items and is required by negative polarity items. Then, it preserves the full entailing presupposition in all cases where it occurs in 'noncanonical' position (for English, not in construction with the finite verb, as in (3c) above) and also when it stands over clefts or pseudoclefts, and when a factive *that*-clause stands in front position as in (7), which fully presupposes that Janet's brother was arrested:

(7) That her brother was arrested did not surprise Janet.

There also is a presupposition-canceling metalinguistic NOT, which says of its argument sentence *BA* that it does not fit into **D** because *A* clashes with **D**, as in (6). This NOT requires heavy accent, must stand in canonical position, and allows for positive polarity items, like *hardly*. How *not* and NOT relate to each other is still a matter of debate.

Gazdar's analysis can thus be perfected and be seen to follow from a postulated mechanism of discourse incrementation.

See also: Anaphora: Philosophical Aspects; Discourse Domain; Discourse Semantics; Polarity Items; Presupposition.

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